asthma been due to other than nasal affections, and that when we have such cases we are doubly justified in going further with our operative procedures. I maintain that when the pathological processes are entirely removed the case will be entirely well. The same nasal conditions that produce asthma, also produce neuralgia, headache, hay fever, etc. In a publication a few years ago by a medical man, he divided asthma as follows: 60 per cent. to nose, 20 per cent. to poisons and toxemias, and about 20 per cent to purely medical conditions. This is practically the same that Doctor Dudley has reported.

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THE RELATION OF LOCAL INFECTIONS TO JOINT AFFECTIONS.*

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In few other branches of medicine is the losing fight of clinical experience against scientific research more evident than in the joint inflammations. The student of medical history will find that until recent years the results of centuries of clinical observation showed that "rheumatism," a clinical entity, embraced all or nearly all cases of arthritis. This rheumatism was due to cold, to overwork, to a run-down condition of the body. It often supervened upon "fevers" and exhausting diseases. It was found in the gouty and in the phthisical, and often followed "sore throat." Lowered resistance enabled it to get a foothold, and the *"locus minoris resistentiae"* determined its abiding place. We recognized acute inflammatory rheumatism, chronic rheumatism, gouty rheumatism and rheumatic gout, scarlatinal rheumatism, gonorrheal rheumatism, syphilitic rheumatism, sciatic rheumatism, and many more. One by one the various constituents of this once protean disease have been identified, described and named, until now rheumatism has come to be restricted almost completely to an acute febrile disease with a well-defined course. The recent discoveries of Rosenow,[1] completing the earlier work of Schüller, Poynton, Paine, and others, and explaining their contradictory findings, indicate that the term soon will become obsolete here also.

Rosenow's work may be summed up briefly as follows: Withdrawing fluid from inflamed ("rheumatic") joints, and using special media, he obtained three types of organisms, with which he produced typical arthritis in rabbits, and obtained pure cultures from these rabbits' joints also. The astounding part of his revelations was, not that he could vary the virulence of his cultures by animal passage, but that by symbiosis, and by the use of various media, he could change his three types into one another, producing at will a streptococcus viridans, a streptococcus hemolyticus, or a diplococcus not to be distinguished from a pneumococcus. The streptococcus hemolyticus showed a marked predilection for the joints, and but little affinity for the endocardium, the streptococcus viridans a marked predilection for the endocardium, while the diplococcus produced not only an endocarditis and an arthritis, but also a myocarditis and a myositis.

The members of this group of Rosenow's are non-pathogenic under certain circumstances. When found in the mouth they are harmless, but in the deep crypts of the tonsil, or in a deep, decaying tooth socket, or in the seminal vesicles, growing under a low oxygen pressure, as Rosenow expresses it, they may take on pathogenicity. Cold increases the virulence of some; hence the influence of cold in producing "rheumatism."

Here at a stroke, if Rosenow's work be confirmed, a great class of acute and chronic joint affections is shown to be due to a group of cocci which form foci of infection in certain favorite situations of the body, and from these foci affect the joint. A rational and scientific basis of treatment of the resulting arthritides should follow shortly. It must be admitted that in spite of very positive assertions by some investigators, much remains to be discovered along this line. I must confess that I have not achieved results with the mathematical certainty claimed by others, but I am still following the trail enthusiastically, confident that it leads in the right direction. It appears that in many of these cases the cocci have a low grade of virulence, and that when the supply of infection is cut off, the joints recover without further treatment.

Many other forms of arthritis already have been shown to be due to a focus of infection elsewhere in the body.

In some cases of acute suppurative arthritis the relation to a focus is established, in others it is not clear. The suppurative arthritis of scarlatina is what we should expect with the suppurative tonsilitis. Possibly the cases of acute suppurative arthritis whose origin always has been a mystery may be caused by the sudden assumption of toxicity by cocci located in the throat and previously harmless.

The case for typhoid arthritis also is established quite firmly, even though aspiration does not always reveal the presence of typhoid bacilli. The same may be said of gonococcic arthritis. Whether or not certain cases of chronic arthritis may be caused by the domicile of typhoid bacilli in the appendix, gall bladder or lymph nodes remains to be determined. It is a strange thing that the chronic inflammation in the deep urethra which causes chronic arthritis is itself caused not by gonococci but by streptococci. The gonococci often die out and leave the streptococci behind.

Syphilitic arthritis is due to an infection else-

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where in the body, and is by no means rare. In spite of the discovery of the spirochete and the Wassermann test, the supreme test of a syphilitic arthritis (I except the Charcot joint) is its reaction to antiluetic treatment. The spirochetae rarely can be demonstrated without infinite pains. In this respect it has borne hitherto a striking analogy to the arthritis caused by a chronic streptococcic infection in the tonsil—Rosenow's streptococci.

Autopsies have shown that a tuberculous arthritis is accompanied in the vast majority of instances by a tuberculous lesion elsewhere in the body. Tuberculous arthritis is probably always secondary, except in the very rare instances of direct infection from the outside. It is distinctly a joint affection following a local infection of some other organ.

An arthritis due to the pneumococcus has been observed occasionally in the late stages of a pneumonia, or as a sequel of the disease. It may or may not be possible in these pneumococcic arthritides to demonstrate the pneumococci.

A pneumococcic, typhoid, tuberculous or syphilitic arthritis may be complicated at any time by a secondary pus infection, and, on the other hand, a chronic encapsulated pus infection in the end of a long bone may give rise to a chronic non-suppurative arthritis. This last may be said to be an example of a joint affection caused by a marrow infection in the immediate vicinity.

Much remains to be found out about joint diseases. We need to accumulate a mass of absolute facts before we may indulge in much theorizing. As it is, we have been given to speculation, rather than to the hard grinding work that must precede sound reasoning. It is well at present to steer clear of dogmatic assertion, but everyone who treats arthritis may formulate his own ideas quite definitely, provided he keep his mind open to the possibility of error. For myself, as the result of clinical and laboratory work, I have reached certain conclusions, which I beg to submit—subject to change without notice:

Arthritis is the response of the tissues of a joint to an irritant. This irritant may be chemical (bacteria or their toxins) or mechanical. In the end the two causative agents are much the same. On this hypothesis gouty arthritis is essentially a traumatic arthritis due to the deposition of crystals of biurate of soda in the joint tissues. In a general way the response of the joint tissues is much the same, no matter what the nature of the irritant.[2] Tuberculosis has a distinguishing characteristic in certain animals, i. e., the tubercle. In other respects it is about the same as the other members of this group.

To ascribe to "metabolic disturbances" a causative role is to be guilty of an evasion. Disturbed metabolism means disease.

No sharp dividing line separates an acute from a chronic arthritis either clinically or etiologically. It is simply a question of intensity and duration of the irritant.

With the exception of the traumatic cases, and of the cases of direct infection from the outside, every case of arthritis is caused by a focus of infection somewhere else in the body, usually a focus in some lymphoid tissue. It may be easy to demonstrate the causal organism in the joint fluid, or it may be very difficult. Possibly the organism may be in the bone marrow and not in the joint cavity. This is sometimes the case in bone tuberculosis, like the condition of a pleural exudate in pulmonary tuberculosis. Again, the organism may be present at times in the joint fluid, and at other times absent.

The essential pathological feature of the great type under discussion is a proliferative inflammation in the marrow of the bone ends, or in the synovia, or in both. All changes in the bone and cartilage are secondary to this.

In most of these diseases, of which tuberculosis and the arthritis caused by the cocci identified by Rosenow are conspicuous examples, the presence of lymphoid marrow and synovial membrane—some peculiarity of their structure—determines the location of the infection in the region of the joints. What this peculiarity is will only appear with a more exact knowledge of the structure and functions of the lymphoid marrow and synovia, and of their relation to the other lymphoid tissues of the body.

As the pathological process at the bottom of all these arthritides is much the same, it follows that their symptomatology is also similar. The diagnosis is not to be made from an inspection of the joint alone, but from a general study of the patient himself and of his history, and even then not absolutely. The joint may be swollen or shrunken, its temperature may be increased or normal, it may or may not contain fluid, constitutional symptoms may or may not be present. Rarefaction of the bone, and thinning and erosion of the cartilage are common to all. The location of the bone rarefaction is not definitely characteristic in any of them, only suggestive. A uniarticular nature prevails with some, a multiarticular nature with others, but here again there is no invariable rule.

Arthritis deformans is a term that should be dropped as quickly as possible, not because it is a bastard mixture of Greek and Latin, but because any joint inflammation may be deforming, and because many non-deforming joint inflammations are doubtless mild examples of the same pathological process which causes the extreme and crippling cases of so-called arthritis deformans. Again, the term arthritis deformans means different things to different men. It does not represent a clinical or a pathological entity, and tends to confusion. It is a relic of the days when we used long names to cover our ignorance. We might with equal reason speak of "nephritis deformans," or of "appendicitis deformans."

Because "rheumatism" and "rheumatoid" are vague terms, and have been used so loosely in the past, it is well to restrict their employment as closely as we can, and to discontinue it entirely as soon as we may.

Treatment.

The subject of treatment of arthritis is so broad that but a small section of it has been allotted to

me for my discourse, namely the Treatment of Tuberculous Arthritis.

I shall confine my remarks to joint tuberculosis in the adult.

To separate what we know from what we think we know is always difficult, and from this difficulty has sprung much of the present confusion in the treatment of joint tuberculosis. I call your attention to a few of the forms of treatment advanced in recent years: Traction, immobilisation, resection, amputation, scraping, drainage, hot air, baths, Roentgen rays, vaccines, injection of all sorts of materials, Stauungshyperaemie. Each based, as it is, on clinical experience, may be said to have been epidemic for a while, and then to persist in an endemic stage in certain localities. As Ludloff puts it: "Die Wahl der Mittel scheint hier immer noch mehr oder weniger persönliche Geschmackssache zu sein."

On the other hand the results of laboratory investigation are also not infallible, but they take us farther than does clinical experience. What we see under the microscope we know, but when we begin to draw conclusions, there is room for a difference of opinion. I shall therefore give first the facts which I have gleaned or which I think I have gleaned from a laboratory study of about 90 joints, tuberculous or thought to be tuberculous. These facts, with the aid of ordinary clinical experience enable me to draw certain conclusions about joint tuberculosis in the adult which no one need accept unwillingly. Everyone may draw his own conclusions.

Joint tuberculosis in the adult is a tuberculosis of the lymphoid marrow in the vicinity of the joint, and of the synovial membrane. Its presence in these tissues affects the nutrition of the other tissues about the joint, but the disease does not attack them directly unless a secondary infection be added. The bone and the cartilage are never attacked directly under any circumstances, but by their presence they influence mechanically the whole course of the disease.

Pure tuberculosis is never found in bone that does not contain lymphoid marrow. Yellow marrow is immune, or practically immune, to the disease.

Tuberculosis may start in the marrow, and later may involve the synovia, or vice versa. Again, it may exist in either of these tissues alone.

From the time of the formation of the first tubercle the disease tends to spread, and nature attempts to wall it in with fibrous tissue, and, in the marrow, with fibrous tissue also. According as one or the other process prevails, the disease tends to extension or to encapsulation. Possibly this statement might be said with reason to border on theory.

The disease as it manifested itself in my specimens was never discrete and definitely encapsulated. Its limits were never sharply defined, and its exact extent could never be determined exactly except by a thorough and exhaustive microscopical examination. It is diffuse, ramifies in every direction, and has certain favorite locations, one of which is the marrow directly beneath the joint cartilage.

With the exception of its peculiar effect on the bone and cartilage, the pathological features of tuberculosis in the joints are those of tuberculosis elsewhere.

Ankylosis in our specimens was always fibrous, and was therefore never complete. Bony ankylosis never supervenes upon adult tuberculosis treated conservatively.

When we come to check up our facts with the histories of the patients from whom the specimens were taken, we make some interesting discoveries. We find in the first place a marked discrepancy between the clinical and the laboratory diagnosis, and, inasmuch as a laboratory diagnosis is much more reliable than a clinical, we draw our first conclusion, namely: A uniformly correct diagnosis of a tuberculous arthritis with our present facilities is an impossibility.

We find further that many of the histories of the patients from whom the joints were taken extend back for years, and that some of the joints were supposed to have been cured by conservative means. In others conservative measures had been tried for long periods in vain. We conclude from this that the cure by conservative means of a tuberculous joint in an adult, especially of a joint in which the bone is involved, must be at least an extremely difficult thing. Remembering the difficulty of diagnosis we draw another conclusion: that most of the cases of supposed tuberculosis in the adult, cured by conservative means were simply instances of mistakes in diagnosis.

All the efforts of Nature toward a cure tend directly or indirectly to deprive the joints of function. These efforts are never effectual. Some function always remains, and the entire process may be lighted up by a strain or a wrench, from a small tuberculous focus persisting after many years.

On the other hand, we find this astonishing fact: If the joint be destroyed by operation, and if secondary infection by pus germs be avoided, the tuberculosis in that region disappears. The disease is cured whether the surgeon removes much or little bone, whether or not he makes a diligent search for tuberculous foci, whether he dissects out the tuberculous synovia, or leaves it almost untouched. We know already from our study of the laboratory specimens that there is usually no way of removing all the tuberculous marrow except by an amputation, no matter what the idea of the operating surgeon may have been.

It is not then by removing all or part of the tuberculous tissue from the joint that the surgeon achieved his cure, for the histories showed that in those cases in which the joint had been curetted or partially dissected out, with this idea in view, the cure had not resulted. It was simply by destroying the joint and by avoiding secondary infection that the cure was attained.

Let us see if we can find any explanation for this. What happens in a knee joint after a resection? I think that this apparently simple question cannot be answered positively. Ollier, basing his

opinion upon museum specimens, said that the spongy bone became dense bone, the lymphoid marrow became yellow marrow, and the synovial membrane disappeared. A series of skiagrams of knee joints which I have resected indicate that this is correct. I believe it to be a fact, but cannot prove it as yet. If it is, the whole rationale of the cure of a tuberculous joint becomes evident. We have learned that the disease exists only in the synovia and in the lymphoid marrow.[3] If these two tissues disappear, the disease will die out. It cannot exist where these two tissues are not. Hence all we need to do to cure tuberculosis in the joint is to destroy function, while avoiding secondary infection.

In the hip the destruction of the joint is accomplished in resections by producing a dislocation or an ankylosis. The impossibility of removing all the diseased tissue from the acetabulum is immediately apparent.

There is no essential difference between tuberculosis of the lungs and of the joints. Doubtless tuberculous foci may occur in the marrow of the bone ends, and may heal up without recognition during life, as they may in the lungs. The uncertainty of any absolutely permanent cure of pulmonary tuberculosis when once it has advanced to clinical recognition is well known. I believe the prospect of a permanent cure of joint tuberculosis in the adult, by conservative means is even poorer. Therefore our rules for treatment of tuberculosis in the adult are:

1. The treatment should always be radical, *as soon as the diagnosis is positively made.*

2. The object of the treatment should be to destroy function in the joint. If this be impossible, every particle of infected tissue must be removed at any cost.

3. Secondary infection should be sedulously avoided.

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2. I except one great type of joint disease from this categlory—Goldthwaite's hypertrophic arthritis, the English osteo-arthritis, the German "arthritis deformans."
3. The internal layer of the periosteum seems to partake of the function and reactions of the marrow in that part of the bone where it is located. It may be considered for our purposes as a layer of external marrow.

THE CURATIVE TREATMENT OF PNEUMONIA, WITH A REPORT ON THE USE OF LEUKOCYTIC EXTRACT.*

By HARRY B. REYNOLDS, M. D., Palo Alto.

Medical research thus far has not developed any means of specifically destroying the invading organisms of pneumonia. Our curative efforts must be limited to aiding the biologic mechanism of attack, defence, and reinforcement. First by putting the patient in a condition of physiologic rest we allow his body cells and fluids to concentrate on the development of his defence. No vital power should be diverted by muscular effort, mental excitement, or nervous fatigue. Nutrition should be as nourishing and as abundant as the patient can dispose of; light solid food when the digestive function is efficient, fluid when the conditions require it. All avenues of excretion must be clear and efficient. The skin, the kidneys and the bowels must be kept active, that waste products of an increased metabolism shall not accumulate to embarrass the defense.

For a successful fight against any infection the animal economy requires an abundance of fluid. I consider the ingestion of large quantities of water a *sine qua non* in the successful management of severe pneumonias. Administered in copious drafts by mouth and by Murphy drip proctoclysis an average adult should take from five to eight pints daily. Normal or twice normal saline may be given by the bowel. When given subcutaneously the use of Ringer's solution possesses distinct advantages in the calcium effect on the heart, a valuable suggestion from Dr. W. W. Kerr.

The maintenance of blood pressure in severely toxic cases I consider a part of a curative therapy. It is best attained by the injection of pituitrin as used by Solis-Cohen [1] at Jefferson Medical College Hospital.

Quinine in large doses in the early days of the disease has, I believe, a curative action on the infection and deserves recognition in a consideration of a rational therapy. In the same way oxygen is not only a symptomatic remedy but is a curative measure in two ways. It stimulates circulation and respiration and by altering the oxygen tension it tends to obviate the formation in the red cells of methemaglobin, sometimes a determining factor of a fatal issue.

Physicians have long hoped for a rational biologic treatment for pneumonia. Thus far however the mortality of the disease has not been affected. Indeed if recent massive statistics by G. A. Gibson [2] are to be believed, the death rate from pneumonia in hospitals is higher in the last decade than in the previous forty years.

Certain attempts have been made to make use of specific sera. Clough [3] of Baltimore has succeeded in protecting mice by the use of human serum but only against the homologous strain of pneumococcus. Indeed, the great barrier to the success of sera lies in their strictly specific limitation to the homologous strain. The great multiplicity of strain of the pneumococcus and its ready mutability seems to render the task impracticable. In 1904 Anders [4] reported on 535 cases treated with anti-pneumococcic serum, and concluded that the results did not warrant its general use. The fact that a serum that is potent to protect an animal from a subsequent inoculation is powerless to aid an animal when once the infection is under way further tends to discourage specific therapy. Still further, it has been shown that a certain concentration of antibody content in the body fluids, the Schwellenwert or threshold concentration of Neufeld and Ungermann [5] is necessary for results even in animal work, a concentration which seems beyond the practical limits of serum administration.

Dochez [6] has apparently made progress in serum

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